

The karnaugh-map package

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Abstract

This package draws karnaugh maps with 2, 3, 4, 5, and 6 variables. It also contains commands for filling the karnaugh map with terms semi-automatically or manually. Last but not least it contains commands for drawing implicants on top of the map. Below is an example of a two variable karnaugh map of $X_0 \oplus X_1$.

		X_0	
		0	1
X_1	0	0	1
	1	1	0

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1 Usage

`karnaugh-map` The `karnaugh-map` environment is the base for this package, and everything related to this package happens inside an instances of this environment.

Usage:

<code>\begin{karnaugh-map}</code>	
<code><*></code>	One asterisk for black and white implicants, non for colored implicants
<code>[\langle X size \rangle]</code>	Number of X-axis cells. Default: "4"
<code>[\langle Y size \rangle]</code>	Number of Y-axis cells. Default: "4"
<code>[\langle Z size \rangle]</code>	Number of X×Y submaps. Default: "1"
<code>[\langle X label \rangle]</code>	Label for the X-axis. Default: " X_1X_0 "
<code>[\langle Y label \rangle]</code>	Label for the Y-axis. Default: " X_3X_2 "
<code>[\langle Z label \rangle]</code>	Label for the submaps. Default: " X_5X_4 "

Example:

Four variable karnaugh map, colored, with X label X_1X_0 , and Y label X_3X_2 .

```
\begin{karnaugh-map}
\end{karnaugh-map}
```

or

```
\begin{karnaugh-map}[4][4][1][\langle X_1X_0 \rangle][\langle X_3X_2 \rangle]
\end{karnaugh-map}
```

Six variable karnaugh map, black and white, with X label ba , Y label dc , and Z label fe .

```
\begin{karnaugh-map}*[4][4][4][\langle ba \rangle][\langle dc \rangle][\langle fe \rangle]
\end{karnaugh-map}
```

1.1 Terms

`\autoterms` The `\autoterms` command fills the remaining unfilled cells of the karnaugh map with the contents of the optional argument.

Usage:

```
\autoterms  
  [content]   Content for the remaining unfilled cells. Default: "-"
```

Example:

Fill all remaining unfilled cells with "-".

```
\begin{karnaugh-map}  
  \autoterms[-]  
\end{karnaugh-map}
```

`\indeterminants` The `\indeterminants` command fills the specified cells with "-" if they aren't already filled. Order of the cell numbers does not matter.

Usage:

```
\indeterminants  
  {cells}      Comma separated list of cells to fill with "-"
```

Example:

Fill the top left and right cell with "-".

```
\begin{karnaugh-map}  
  \indeterminants{0,2}  
\end{karnaugh-map}
```

`\manualterms` The `\manualterms` command fills the 0th cell with the first element in the argument, the 1st cell with the second element in the argument, and so on. If any of the cells already is filled, it is left as it was.

Usage:

```
\manualterms
  {<content>}    Comma separated list of cell contents
```

Example:

Fill the first four cells with 0, 1, 0, and 1 respectively.

```
\begin{karnaugh-map}
  \manualterms{0,1,0,1}
\end{karnaugh-map}
```

`\maxterms` The `\maxterms` command fills the specified cells with "0" if they aren't already filled. Order of the cell numbers does not matter.

Usage:

```
\maxterms
  {<cells>}    Comma separated list of cells to fill with "0"
```

Example:

Fill the top left and right cell with "0".

```
\begin{karnaugh-map}
  \maxterms{0,2}
\end{karnaugh-map}
```

`\minterms` The `\minterms` command fills the specified cells with "1" if they aren't already filled. Order of the cell numbers does not matter.

Usage:

```
\minterms
  {<cells>}    Comma separated list of cells to fill with "1"
```

Example:

Fill the top left and right cell with "1".

```
\begin{karnaugh-map}
  \minterms{0,2}
\end{karnaugh-map}
```

1.2 Implicants

`\implicant` The `\implicant` command draws quadratic implicants on one or multiple submaps. If the implicant shall be drawn on multiple submaps, `{\northwest cell}` and `{\southeast cell}` must be specified as if the implicant was to be drawn on the 0:th submap. When turned on, colorization is done automatically, following a global sequence of available colors.

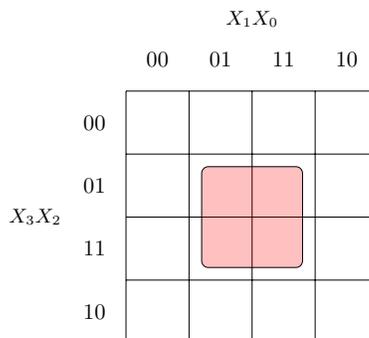
Usage:

```
\implicant
{\northwest cell} The most northwest cell in the implicant
{\southeast cell} The most southeast cell in the implicant
[{\submaps}]      Comma separated list of submaps the implicant should be drawn
                  on. Default: "0"
```

Example:

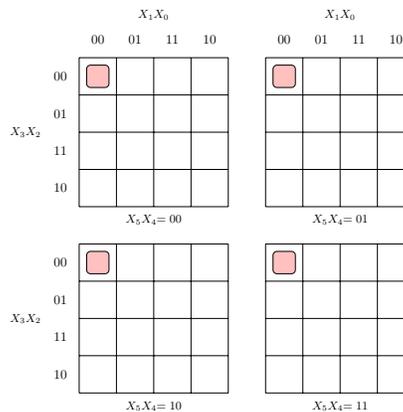
Implicant around the four most inner cells.

```
\begin{karnaugh-map}
\implicant{5}{15}
\end{karnaugh-map}
```



Single cell implicant, 0:th cell, on all four submaps.

```
\begin{karnaugh-map}[4][4][4]
\implicant{0}{0}[0,1,2,3]
\end{karnaugh-map}
```



`\implicantedge` The `\implicantedge` command draws quadratic implicants with the middle of the implicant facing the edge of a submap either horizontally or vertically. The function is able to draw the same implicant on one or multiple submaps. However if the implicant shall be drawn on multiple submaps, $\{\langle northwest\ part - northwest\ cell \rangle\}$, $\{\langle northwest\ part - southeast\ cell \rangle\}$, $\{\langle southeast\ part - northwest\ cell \rangle\}$, $\{\langle southeast\ part - southeast\ cell \rangle\}$ must be specified as if the implicant was to be drawn on the 0:th submap. When turned on, colorization is done automatically, following a global sequence of available colors.

Usage:

```

\implicantedge
  {\langle northwest part - northwest cell \rangle} The most northwest cell in the northwest part
  {\langle northwest part - southeast cell \rangle}   of the implicant
  {\langle southeast part - northwest cell \rangle} The most southeast cell in the northwest part
  {\langle southeast part - southeast cell \rangle}  of the implicant
  [\langle submaps \rangle]                          The most northwest cell in the southeast part
                                                    of the implicant
                                                    The most southeast cell in the southeast part
                                                    of the implicant
                                                    Comma separated list of submaps the implicant
                                                    should be drawn on. Default: "0"

```

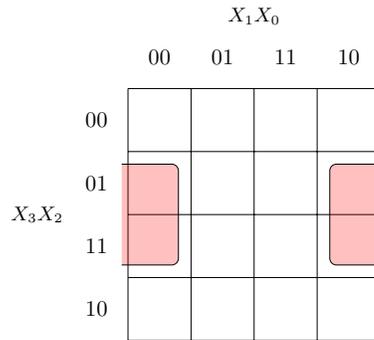
Example:

Horizontal implicant over the submap edge containing the cells 4, 6, 12, and 14.

```

\begin{karnaugh-map}
  \implicantedge{4}{12}{6}{14}
\end{karnaugh-map}

```



`\implicantcorner` The `\implicantcorner` command draws an implicant around only the four corner pieces on one or multiple four variable karnaugh submaps. When turned on, colorization is done automatically, following a global sequence of available colors.

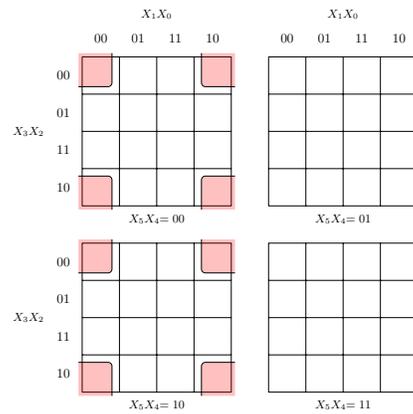
Usage:

```
\implicantcorner
  [submaps]      Comma separated list of submaps the implicant should be drawn
                   on. Default: "0"
```

Example:

Draw an implicant around all corners on 0th and 2nd submap of a six variable karnaugh map.

```
\begin{karnaugh-map}[4][4][4]
  \implicantcorner[0,2]
\end{karnaugh-map}
```



2 Examples

Draw a karnaugh map for $f(a, b, c, d, e, f) = \Sigma(0, 1, 2, 3, 8, 13, 17, 20, 22, 28, 33, 32, 30, 19, 40, 35, 49, 42, 34, 10, 60, 54, 62, 51, 52) + d(15, 45, 47)$.

```

\begin{karnaugh-map}[4][4][4][\$ba\$][\$dc\$][\$fe\$]
  \minterms{0,1,2,3,8,13,17,20,22,28,
    33,32,30,19,40,35,49,42,34,10,60,
    54,62,51,52}
  \indeterminants{15,45,47}
  \autoterms[0]
  \implicantcorner[0,2]
  \implicant{1}{3}[0,1,2,3]
  \implicantedge{4}{12}{6}{14}[1,3]
  \implicant{13}{15}[0,2]
\end{karnaugh-map}

```

Draw a karnaugh map for $f(X_0, X_1) = \Pi(0, 2, 3)$ in black and white.

```

\begin{karnaugh-map}*[2][2][1][\$X_0\$][\$X_1\$]
  \maxterms{0,2,3}
  \autoterms[1]
  \implicant{1}{1}
\end{karnaugh-map}

```

3 Dependencies

- tikz
- xparse
- xstring